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RE: ***Economic Evaluation of Water Management Alternatives, Screening Analysis and Scenario Development.*** **Draft. June 1999.**

This letter provides comments on the above CALFED document, herein called the Draft. Specific pages from the Draft are identified by square brackets, for example [4-2] means chapter 4, page 2. The notation (R1), for example, means reference 1 listed at the end of these comments.

Comment 1 - concerning responsible authors for the Draft and editing of the Draft.

The public has a right to know who wrote and/or was consulted on this document, especially the unnamed "working group of economists" [4-2] who agreed with DWR and MWDSC price elasticities. I happen to disagree with them but that's not the point here. The point, as correctly stated in the Draft, is that price elasticity is an important technical issue since it tells us how price influences conservation. "Expert judgement" [2-1] is often necessary but experts that give opinions should identify themselves and their employer.

The authors who are responsible for the Draft, either in an overall review sense or for particular sections, should also be identified. The DWR water plan (R1) is a good model: more than 80 contributors and editors are listed.

The Draft could use some editing. For example, price elasticity of demand is defined incorrectly [2-3] relative to later usage. The phrase "...literally, the percentage reduction in quantity..." should be replaced by "...the percentage change in quantity...." If you prefer to keep

your definition, then scrub the minus signs from all subsequent numerical estimates. Appendix A has a grand total of 55 graphs; all graphs are incorrectly labeled and, to make matters worse, all are poorly labeled! The ordinate (y-axis) is the price axis and should be labeled "Price, $/AF", the meaning of the label "i, AF" is a mystery. Each graph proudly announces in the title "Screening Level Analysis". This standard bit of boilerplate was stated on page A-1 and need not be repeated *ad nauseam* on every graph. If you want to help the reader understand what is going on, "Supply Increments and Demand Curves" is a suggestion, but ask an editor. Paragraph 1 [B-2] of Appendix B is gratuitous and biased. If you can't see why, ask a professional editor.

Comment 2 - concerning the current single-family residential elasticity estimate.

The estimate of -0.16 [4-2] is too low. The Draft, or more precisely "A working group of economists" starts out by endorsing "new evidence" [4-2, Renwick *et al.*, 1998] cited by DWR on single-family residential price elasticity. However, the latest study is not necessarily the best study. DWR actually cites "Renwick et al., 1996" which seems, by the description, to be the same study. The DWR and CALFED endorsement is a disappointment, especially in view of critical comment letters on the DWR draft (R1).

I have the following specific objections to the 1998 study of Renwick *et al.*, referred to below as the Study.

(a) The Study's price elasticity estimate is not within the central range of prior studies. This range is admittedly broad, since each study has special features and data limitations, but Mitchell and Hanemann, for example, conclude that 20 years of research suggests price elasticity to be in the range -0.2 to -0.5 (R2, p12).

(b) The Study's results are distorted by over-aggregation with respect to income and lot size. There is an enormous range of incomes and lot sizes within any metropolitan area and an associated large range in water use. Price elasticity is a relatively small effect that is easily buried beneath the more important effects of income and weather. It is unrealistic to expect that the aggregate differences between water districts will account for household income and lot size effects (the authors neglected to report summary statistics on their data that could show this).

(c) The 1998 paper by Renwick and Archibald (R3), cited in the Study, has been ignored both by DWR and by CALFED's economists. That work found a price elasticity value of -0.31 based on a panel of 119 households over six years. The argument that the Study covers 7.1 million people cuts both ways. Panel studies with smaller numbers of

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well-characterized households can be superior while over-aggregated studies that cover millions can produce mainly noise, e.g. the study by Nieswiadomy (R4) using AWWA survey data covering most of the U.S. population.

(d) Weather should have been handled with an evapotranspiration (ET) model. Weather effects are important and rather well understood technically. There is no reason to fall back on a century-old Fourier decomposition except as a desperation measure when lacking technical insight into a periodic effect. One can do well with a 2-parameter ET model while the Study's Fourier approach started with 13 parameters and, even after testing down, wound up with a non-parsimonious total of 4 parameters.

(e) The Study uses the obsolete Taylor-Nordin two-price specification for block rates. This concept has had its day and that day is over. There was a flurry of interest in the late 1970s and early 1980s with arguments for and against which basically died after Berndt's (R5) textbook analysis. Berndt proved that the effect, while theoretically real and expressed via a difference-price parameter that is actually an income correction, will be negligible for a low-price economic good using a small share of household income. The problem with using a two-price model for data fitting is that the second parameter is usually not found to be negligible due to a lack of parsimony (R6), i.e. parameter overload: price elasticity is relatively small and easily distorted. One simply can't afford to have two adjustable price parameters in the analysis.

(f) The efforts of the authors to incorporate price and non-price effects in their analysis in a quantitative way may be admirable, but the problem is difficult and it is not at all clear that they have been successful. To be convincing, the authors should at least have compared the overall data fit with a simpler, traditional model without non-price effects.

(g) The Study, in general, lacks parsimony and involves too many parameters chasing over-aggregated data.

Comment 3 - concerning 2020 demand elasticity for all-municipal use.

I would appreciate it if someone would give me some peer-reviewed references on what the Draft refers to as "...a phenomenon called demand hardening..." [4-2]. The 2020 all-municipal use estimate of -0.042 for price elasticity by Metropolitan is too low. The assertion that planned water conservation measures will reduce price elasticity to essentially zero (-0.042) is incorrect. Worse than that, it seems that Metropolitan would have us come full circle: by 2020 we

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will be back to the bygone era of water-requirements planning where price effects were ignored. In effect, Metropolitan is saying: leave it to us, we're the experts, after we carry out all our BMPs our projected 2020 water needs are sacrosanct. I might begin to believe this if all South Coast residences were required to convert to appropriate desert landscaping.

Comment 4 - price should not be ignored as a conservation tool for urban water.

The Draft starts out with a bias against price effects: "Urban demand is relatively unresponsive to changes in price." [1-5]. The statement is true but misleading if used as an excuse to ignore what can be done with a tiered rate structure. The Draft seems to be following DWR, unfortunately DWR is misleading and equivocal on price effects: "Water price plays a small role..." (R1, 4-8). But five pages later we read: "...it could become more important if water prices increased substantially." (R1, 4-13). To appreciate why price can be important for household use, one has to understand the large variation in water use within any major water district. Attachment 1 (R7) shows the single-family residential water-use distribution for East Bay Municipal Utility District (EBMUD) for 1992-93. If the distribution were "normal" (bell-shaped) with a small variance, in other words if everyone used nearly the same amount of water, there would be no need for a tiered rate structure with inclining block rates and no need for this comment. In fact, the distribution is highly skewed towards large water users. In gallons per day per household account, water-usage percentiles updated to 1995 are approximately:

EBMUD Annual Average Water Use
[GPD/household, rounded]

Percentile	East	West	Overall
Bottom 20%	110	60	70
Bottom 40%	160	90	100
Bottom 60%	220	120	130
Bottom 80%	290	150	170
Top 20%	1100	440	620
Top 10%	1400	540	820
Top 5%	1800	650	1100
Top 1%	2800	950	1800
Overall	470	220	270

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East and west district differences are due partly to microclimate effects: the eastern service areas are inland across a range of hills and are warmer. The differences are also highly income dependent. Household income is higher in the eastern areas by an overall factor of two but with considerable variation within particular service areas as shown in Attachment 2 (R8).

Residential water customers as a group are considered, especially for drought planning purposes, to be discretionary users relative to non-discretionary commercial and industrial users. But since the top residential quintile uses nine times as much water as the bottom quintile it is clear that some households have a lot more discretion than others. The notion of "demand hardening" is ridiculous for the top quintile households: this small group consumes half the residential water supply!

Comment 5 - increasing price to reduce landscape water use in 2020.

South Coast and SF Bay urban use is projected as 7296 TAF in year 2020 after BMPs [4-3]. Assume these two major urban areas have similar characteristics and neglect the rest of urban California for simplicity and to be conservative. We know that approximately two-thirds of South Coast use is residential (R9) and that about 72% of residential use is single-family residential (SFR) use (R10). Assuming the top quintile uses 48% of total SFR consumption (Attachment 1) then this small fraction of all California households can be expected to consume 23% of total urban water or 1680 TAF in 2020. The top quintile averages about 620 GPD (see table above), i.e. about 620/170 = 3.6 times as much as the bottom 80%, with the excess devoted mainly to exterior landscape watering: roughly (620-170)/620 X 1680 = 1200 TAF. This number can be compared to the DWR estimate of 3600 TAF in 2020 for all California landscape irrigation (R1, 6-10).

Suppose the South Coast base price is doubled from the present baseline price [4-1] of $625/AF to $1250/AF for the top tier of a conservation rate structure and neglect any water-use reduction in the lower quintiles. Assuming a realistic and probably conservative estimate for price elasticity of -0.3 for top-quintile exterior water use, then demand falls from 1200 TAF to 975 TAF in 2020, a water reduction of 225 TAF. This figure is comparable to the DWR estimate of exterior water savings achievable by lowering irrigation from 1.0 ET_0 to 0.8 ET_0 for all Californians via "retrofitting" at an unknown cost to be "...funded by water purveyors..." (R1, 6-10, Option 2). Since water purveyors simply pass costs along, costs would be borne by all ratepayers collectively: in effect, lower-income ratepayers would be subsidizing the "retrofitting" for higher-income, large water users! In contrast, conservation rates can be used to accomplish the same result without penalizing moderate water users.

Sincerely,

Albert E. Sherwood

References

(1) *California Water Plan Update Bulletin 160-98.* Department of Water Resources, November 1998.

(2) Mitchell DL, Hanemann M. *Setting Urban Water Rates for Efficiency and Conservation.* M.Cubed, Oakland, CA. June 1994.

(3) Renwick ME, Archibald SO. Demand side management policies for residential water use: who bears the conservation burden. *Land Economics* 1998;74:343-359.

(4) Nieswiadomy ML. Estimating urban residential water demand: effects of price structure, conservation, and education. *Water Resources Research* 1992;28:609-615.

(5) Berndt ER. *The Practice of Econometrics: Classic and Contemporary.* Addison-Wesley, Reading, MA, 1991.

(6) Kennedy P. *A Guide to Econometrics, 3rd Ed.* MIT Press, Cambridge, MA, 1992.

(7) Sherwood AE. *Water Price Policy for EBMUD: Proposal for a Linear Rate Structure.* Alamo, CA. March 1995.

(8) Sherwood AE. *Water Price Policy for EBMUD: Proposal for a Multi-Step Rate Structure.* Alamo, CA. February 1993.

(9) Baumann DD, Boland JJ, Hanemann WM. *Urban Water Demand Management and Planning.* McGraw-Hill, New York, 1998.

(10) *East Bay Municipal Utility District, Water Rate Structure Study.* CH2M Hill, Oakland, CA. April 1995.

Attachment 1: Figure 1. EBMUD single family water use distribution.

Attachment 2: Figure 7. Water use depends more on income than on the weather.

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Attachment 1
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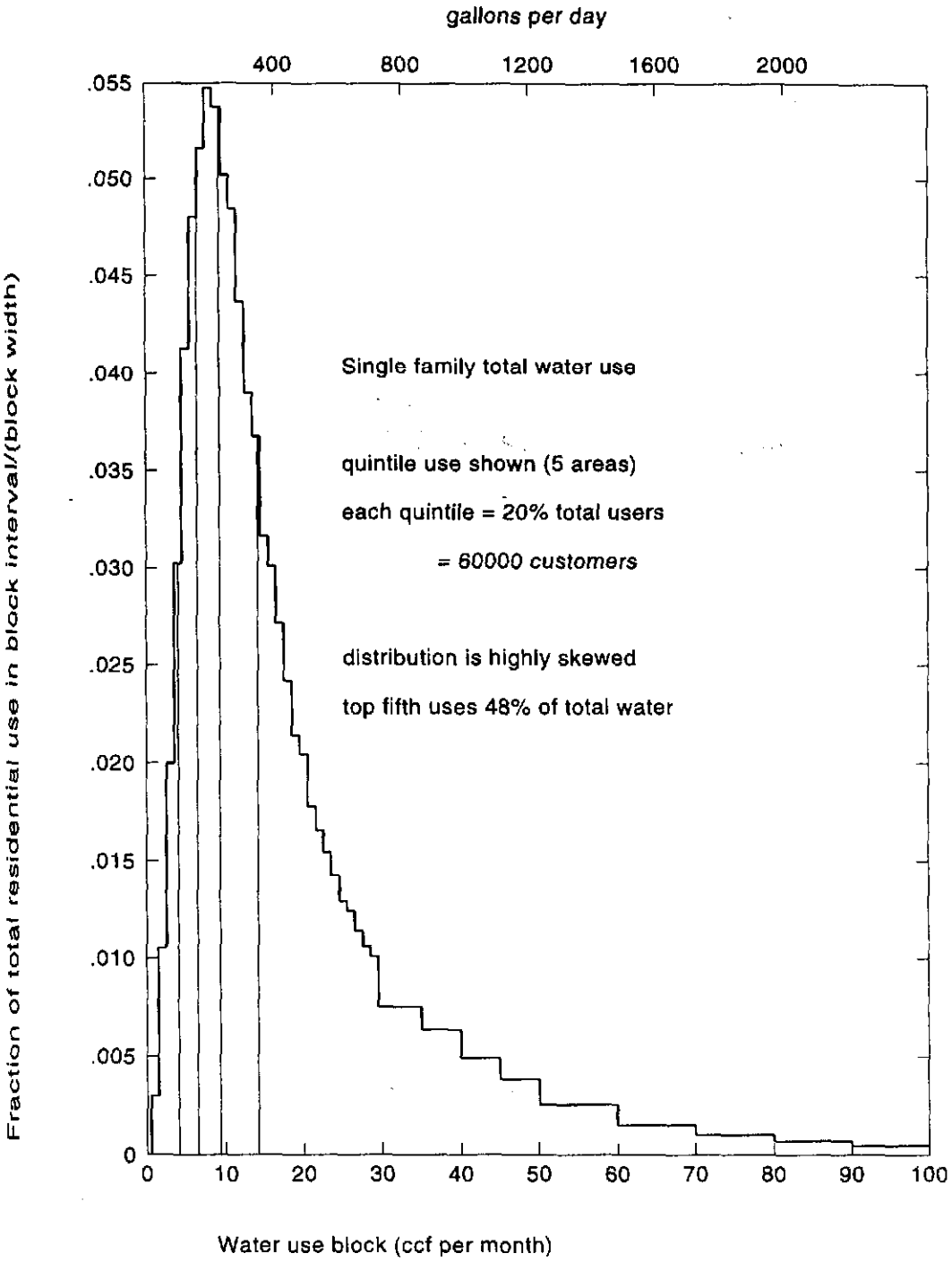

Figure 1. EBMUD single family water use distribution.

Calendar years 1992 and 1993 combined.

Total area under curve (≈1.00) includes all users.

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Attachment 2
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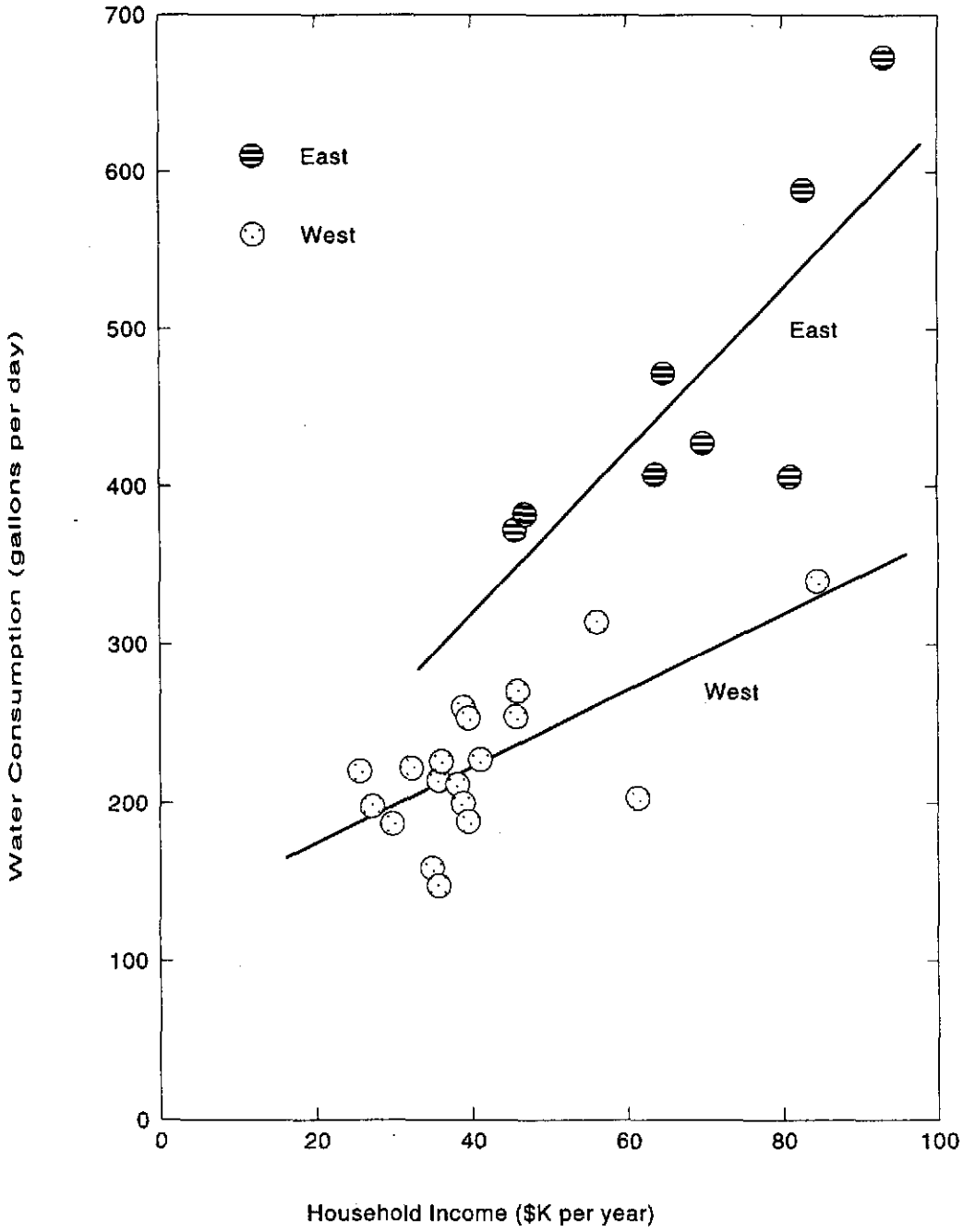

Figure 7. WATER USE DEPENDS MORE ON INCOME THAN ON THE WEATHER

Annual average water consumption for EBMUD service areas versus 1990 median household income. Lines labeled East and West are a least-squares fit to respective service areas (8 East District and 19 West District).